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Stinking Smut of Wheat in Alberta

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STINKING SMUT OF WHEAT IN ALBERTA

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INTRODUCTION.

Stinking smut or bunt of wheat has been causing much unnecessary loss during the past few seasons, not only in western Canada, but as well in neighboring states of the United States. During the summer of 1930, 286 fields were examined at random in Alberta, and 12.6 per cent. were found to contain stinking smut. Since the grain has come on the market more evidence of the prevalence of this smut has been obtained. In the inspections made at Edmonton for instance, during the period October 15 to March 30, between one and two and a half per cent. of the earloads of wheat examined have graded smutty. This means a reduction in price often amounting to from five to ten cents per bushel, in addition to the loss in yield which has occurred in the field.

HOW TO RECOGNIZE STINKING SMUT.

Everyone who is growing wheat should be able to recognize stinking smut. It may be quite conspicuous when it becomes abundant, but may be overlooked if only a small amount is present. This disease is not detectable in the field until the grain heads out. Diseased heads are usually darker green than normal heads, and hence have an abnormal appearance. The chaff is not destroyed, but some or all of the kernels are replaced by smut balls (Fig. 1). These are usually plumper than normal kernels and are consequently often more exposed as they force the chaff farther apart. If at maturity one of these smut balls is crushed, it will be found to contain a black powder which is made up of countless numbers of very tiny spores (Fig. 2), the seed, so to speak, of the smut fungus which causes the disease. This powder has a very characteristic odor, hence the name "stinking" smut. When the grain is threshed, many of the smut balls are broken and the black spores become deposited on the normal wheat kernels. They frequently lodge in the brush ends of the wheat kernels. Such



Fig. 1.—Stinking Smut of Wheat.
Left, diseased head. Right, healthy head.

infested grain is also readily detected by the characteristic odor. Some of the smut balls may pass through the threshing process without being broken. They may easily be distinguished, however, from the normal wheat grains (Fig. 3).

Smutty grain must be thoroughly scoured before it can be ground into flour. Otherwise the flour and bread made from it would be discolored; hence the discrimination against smutty grain and the reduced price paid for it.

CAUSE OF STINKING SMUT.

Stinking smut or bunt is caused by a microscopic plant, a fungus which lives a parasitic life on the wheat plant. The spores or seed of this fungus serve to propagate and spread it. When wheat seeds bearing these spores are sown, the latter germinate when the wheat seeds germinate, and produce thread-like processes which are capable of penetrating and infecting the young wheat seedlings. The fungus then grows inside of the infected plants, remaining concealed until the plants head out, when it may be observed that it has reproduced itself by the formation of spores in smut balls which replace some of the kernels.

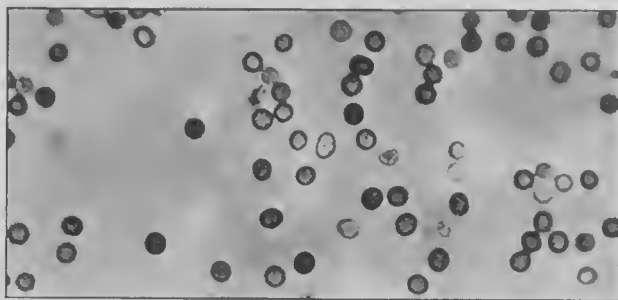


Fig. 2—Spores of stinking smut fungus (magnified about 137 times). Each smut ball contains several million spores.

SOURCE OF INFECTION.

In order to devise control measures for this disease, it is important to know the source or sources of infection. It has been repeatedly demonstrated that seed-borne spores carried on the outside of wheat kernels constitute the principal source of infection in spring wheat. The question is frequently asked, however, "Is it not possible for wheat to become infected from soil-borne spores?" It is well known, for example, that when a smutty crop is threshed, many spores blow away from the separator and lodge on nearby fields. Experiments conducted at Edmonton have shown that winter wheat may become infected from such soil-borne spores. However, if spring wheat is sown in these fields there is little likelihood of it becoming infected, apparently because the smut spores ger-

minate either in the fall or spring before the spring wheat is sown. Hence if we kill the spores on the seed of spring wheat by treating the seed with suitable disinfectants, we can be reasonably certain of controlling the disease.

USE OF SMUTTY WHEAT FOR SEED.

Although it is possible to control stinking smut of spring wheat by treating the seed, it is not advisable to use smutty wheat for seed. It is seldom necessary to use smutty grain for seed, as plenty of good seed is now available at reasonable prices, and it is good business on the part of the grower to use the best seed obtainable. The smuttier the grain the more difficult it is to obtain perfect control. It can be done, but the extra care necessary may entail more work and expense than is warranted. Moreover, there is always the possibility of recontamination after treatment and of polluting granaries and other containers used for storing or handling the grain.

REMOVAL OF SMUT BALLS.

Smutty wheat frequently contains a considerable percentage of smut balls. If used for seed these should be removed, as the spores in them may serve to recontaminate the grain after treatment. If a good fanning mill is available, it may be possible to remove them by repeated cleaning. In order to do this it probably will be necessary to run the grain in thin streams several times through the mill and to expose it to a heavy blast of wind. It may be necessary to sacrifice some of the grain, in order to remove all of the smut balls. If the formaldehyde immersion method of treatment is used, a large



Fig. 3—Left, smut balls. Right, normal wheat kernels.

percentage of the smut balls will float to the surface of the liquid and can be skimmed off and destroyed. Some of the heavier smut balls, however, may not float and hence will not be separated from the grain (see later discussion under formaldehyde). It is possible to remove all of the smut balls by immersing the grain before treatment in a 20 per cent. solution of common salt which will cause all of them to float, whereupon they may be skimmed off as before. The grain should be washed with water afterward, however, before treating it with formaldehyde in order to avoid possible injury of the seed by the salt solution.

TO TREAT OR NOT TO TREAT.

One reason for the prevalence of stinking smut is that there are always some growers who are negligent about treating their seed. It is felt by some that treatment of the seed involves unnecessary work and expense, especially if stinking smut has been absent over a period of years. Sooner or later smut will creep in, however, and those who have relaxed their vigilance are the ones most likely to suffer. In some districts this has resulted from the introduction of a more susceptible variety than has previously been grown. For instance, it has been noted in a number of districts where Red Bobs or related wheats such as Early Triumph or Supreme have been substituted for Marquis. Red Bobs is considerably more susceptible to stinking smut than Marquis, Garnet and several other varieties. Seed treatment is practised regularly by the great majority of our best farmers, and must be regarded as the safest plan and the best insurance against stinking smut. It should be done carefully and properly, however, as it is possible to do more harm than good if improper methods are used.

AVAILABLE SEED DISINFECTANTS FOR TREATING WHEAT.

There are many disinfectants which will control stinking smut of wheat, but there are relatively few which are sufficiently cheap, efficient and easy to apply to render their use practicable in a large way. Of these, formaldehyde and copper carbonate are the ones in most common use at the present time. Formaldehyde is used in liquid form and copper carbonate as a dust. The former is more extensively used on farms than the latter. Both have certain merits and limita-

tions which should be known and carefully considered by wheat growers who may use them.

FORMALDEHYDE.

A solution consisting of 1 part of formalin to 320 parts of water is the standard mixture used for treating wheat and other grains for the control of covered smuts. This may be made up in large quantities by using 1 pint of commercial formaldehyde to 40 gallons of water. For small quantities it is convenient to measure in fluid ounces at the rate of 1 ounce to 8 quarts of water. Thus to a 12 quart pail of water it is necessary to add $1\frac{1}{2}$ ounces of commercial formaldehyde. Convenient measuring dishes for making up small quantities of the solution may now be obtained from dealers handling formaldehyde. It should be noted that the proportions given are according to Imperial measure. The recommended strength should not be exceeded, as the germination of the seed may be seriously reduced and the vigor of the resulting stand may be weakened if stronger concentrations are used. Even when the proper strength is used some seed injury usually is experienced. This may be accentuated if seeding is delayed after treatment, or if the treated grain is sown in dry soil.

The solution should be applied in such a way that all seeds are thoroughly wetted. The best type of machine to use is one that will remove smut balls. However, if smut balls are not present the solution may be applied with other types of grain picklers or by sprinkling it on the grain as it is shovelled from one heap to another. If smut balls are present in the grain, provision for removing them by other methods not having been made, an immersion method should be employed, preferably using a commercial machine as suggested above which will skim off the smut balls. If one of these is not available the next best plan to follow is to pour the grain loosely into a tub of the solution, then stir it and skim the smut balls off the surface. The solution may then be drained off through a hole, covered with a screen, near the bottom of the tub and used again. While a few smut balls may sink and remain in the grain, recontamination by spores in these may be largely avoided if the precautions noted below are followed. After treatment the grain should be covered for at least four hours and then sown immediately.

If grain treated with formaldehyde is allowed to dry it may readily be recontaminated. Hence precautions should be taken to avoid this. All containers used for handling the grain should be treated with the formaldehyde solution. If possible the treated grain should be sown while still damp. In that condition any smut spores which reach it will be killed.

COPPER CARBONATE DUST.

Wheat may be treated quite satisfactorily with copper carbonate dust provided it is not too badly smutted. Most brands of copper carbonate dust on the market contain 18-20 per cent. copper. These are cheap enough to make their use practicable, when applied at the rate of 2 oz. per bushel of seed. If the grain to be treated is visibly smutted it may require heavier applications (3-4 ounces per bushel) and stronger brands (for example, those containing 50 per cent. copper) to give satisfactory control. Such grain should not be used for seed, but if it is used it would seem better in most cases to treat it with formaldehyde rather than with copper carbonate. If relatively clean grain is sown, and if it is treated regularly every year with a good brand of copper carbonate at the rate of 2 oz. per bushel, there need be no fear of stinking wheat.

In the application of copper carbonate dust it is essential to use a machine which is dust-tight and in which the dust and grain can be mixed properly by rapid rotation of the container. Commercial power driven machines are usually most efficient, but home-made machines can be used quite satisfactorily. A common type consists of a barrel mounted and operated in a similar manner to a rotating churn. The mixing cannot be efficiently done by shovelling the grain and dust together.

Copper carbonate has certain advantages as a disinfectant for wheat over formaldehyde which it is well to take into consideration. The chief one is that it causes no seed injury. On the other hand, there is always some risk of seed injury when either formaldehyde or bluestone is used. The fact that grain can be treated at any time with copper carbonate is a point in its favor which appeals to some growers. Furthermore, grain treated by this method is better protected, though not absolutely, from recontamination than is seed which has become dry after having been treated with formaldehyde.

If copper carbonate is used certain precautions should be exercised. Because of the fact that the dust is nauseating to some people, it is well to do the treating outside or where there is a good circulation of air. A dust mask or moist cloth may be worn to prevent the dust from being inhaled. When sowing dust-treated grain it is well to oil the gear bearings of the drill frequently to prevent wear. After standing it is well to turn the feed shafts with a wrench before using in order to avoid possible gear breakage from accumulated dust. It is also well to remember that treated grain is poisonous and should not be fed to live stock.

GENERAL CONCLUSIONS.

Smut-free seed should always be used if possible.

It is safest to treat with a disinfectant whether the seed appears smutty or not.

Formaldehyde and copper carbonate appear to be the cheapest and most satisfactory disinfectants available at present. Each has its merits and limitations.

If it is necessary to use visibly smutty wheat for seed, formaldehyde is likely to give more efficient control than copper carbonate dust, provided sufficient precautions are taken to avoid recontamination after treatment. Smut balls if present in the sample should be removed, and the treated grain should be sown while still damp if possible. Formaldehyde is also commonly used on grain which is not smutty.

Danger of seed injury, and other undesirable features of the formaldehyde treatment, may be avoided by using copper carbonate dust. It will give adequate protection from stinking smut to samples of good spring wheat seed and even to lightly smutted samples. It must of course be properly applied with a dusting machine.

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